

# Mission Summary

## 20060826N Aircraft 49RF

### SALEX Flight 2006

#### Scientific Crew (49RF)

Lead Scientist	Jason Dunion
Dropsonde Scientist	Sim Aberson
Visiting Scientist	Jeff Hawkins

#### Aircraft Crew (49RF)

Aircraft Commander	Michele Finn
Pilots	John Longenecker Will Odell
Project Manager	Jack Parrish
Flight Meteorologist	Barry Damiano
Equipment Specialist	Gordon Kitson
Electronics Technician	Dale Carpenter
Electronics Technician	Chuck Rasco
Electronics Technician	Jeff Smith

#### Mission Plan:

NOAA 49RF will fly a Saharan Air Layer Experiment (SALEX) around Tropical Depression Debby as part of IFEX. The G-IV will leave Barbados at 1450 UTC and will recover back at Barbados at 2115 UTC. The flight track will initially take the G-IV south and east of the storm, followed by an approximate overflight of the exposed center of circulation and return to Barbados. Fig. 1 shows the flight track, along with the 26 dropwindsonde points.

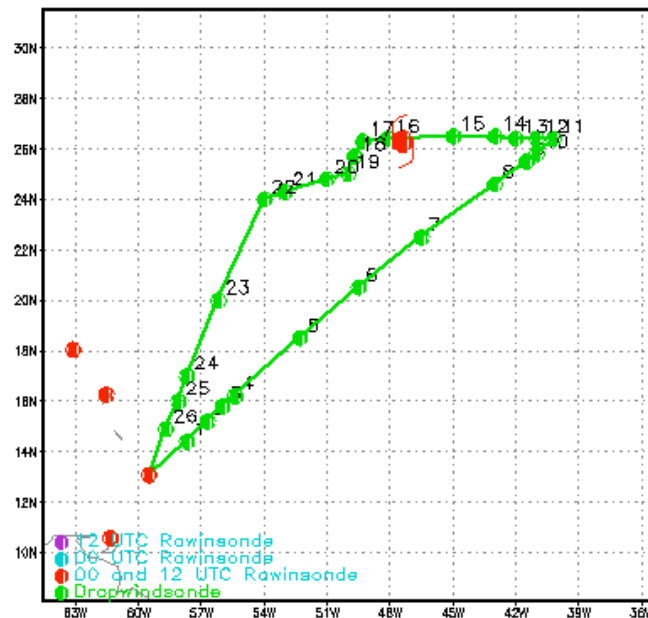


Fig. 1: Flight track (green line) for SALEX mission 060826n. The GPS dropsonde points (26 total) are indicated by green circles.

## Mission Summary:

### a) Synoptic Situation

Pre-Tropical Storm Debby emerged from the coast of North Africa as a well organized AEW on 21 August (Fig. 2). Figure 2 also shows that a very large Saharan Air Layer (SAL) outbreak was located to the north and west of this system at this time. The NASAS DC-8 flew a single mission into pre-Tropical Storm Debby on 23 August from Sal, Cape Verde. This mission was part of the NAMMA field program and the main objectives included cyclogenesis, Saharan Air Layer/dust, and microphysics studies. The disturbance tracked to the northwest [around the southwest periphery of a deep layer ridge, Fig. 3 (left)] over the next several days, which brought it into the suppressive influence of SAL and within range of the NOAA G-IV. The G-IV was deployed to Barbados on 24 August for a back-to-back set of SALEX missions (25 and 26 August).

At 1800 UTC during the day of the mission, Tropical Depression Debby was located at  $\sim 26.3^\circ\text{N}$   $47.4^\circ\text{W}$ . A large deep layer ridge was located to its northeast [Fig. 3 (left)], an east-west elongated ridge was positioned to its west [Fig. 3 (left)], and an amplifying upper-level cold low was located  $\sim 600$  km to its southwest at  $\sim 25^\circ\text{N}$   $53^\circ\text{W}$  ([Fig. 3 (right)]). The center of the storm was under the influence of  $\sim 20$ - $25$  kt of southerly shear, which was likely being enhanced by the nearby amplifying upper-level cold low (Fig. 4).

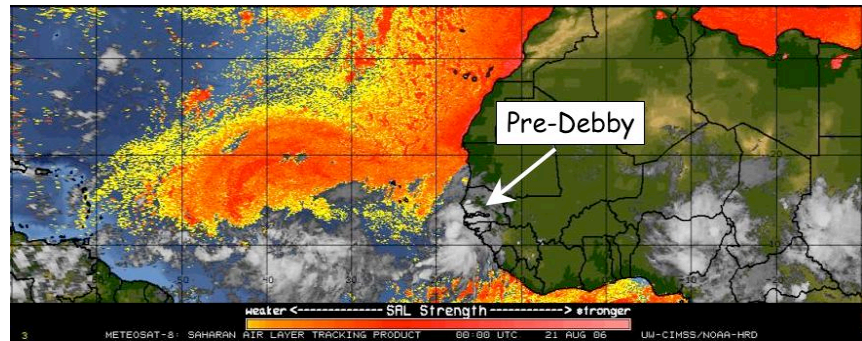


Fig. 2: SAL imagery (21 August 0000 UTC) showing a large SAL outbreak (yellow to red shading) north and west of the AEW that eventually developed into Tropical Storm Debby.

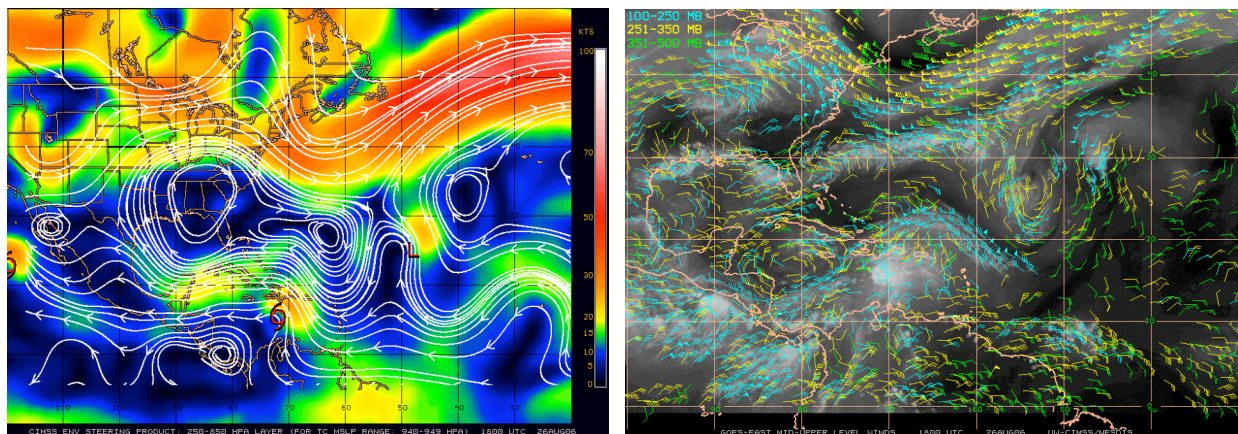


Fig. 3: Plots of (left) 250-850 hPa deep layer mean steering [magnitude (direction) of the steering flow is indicated by colored shading (white streamlines)] and (right) mid to upper-level GOES water vapor winds for 26 August 1800 UTC. Debby was located at  $\sim 26.3^\circ\text{N}$   $47.4^\circ\text{W}$  at this time. Images courtesy of UW/CIMSS.



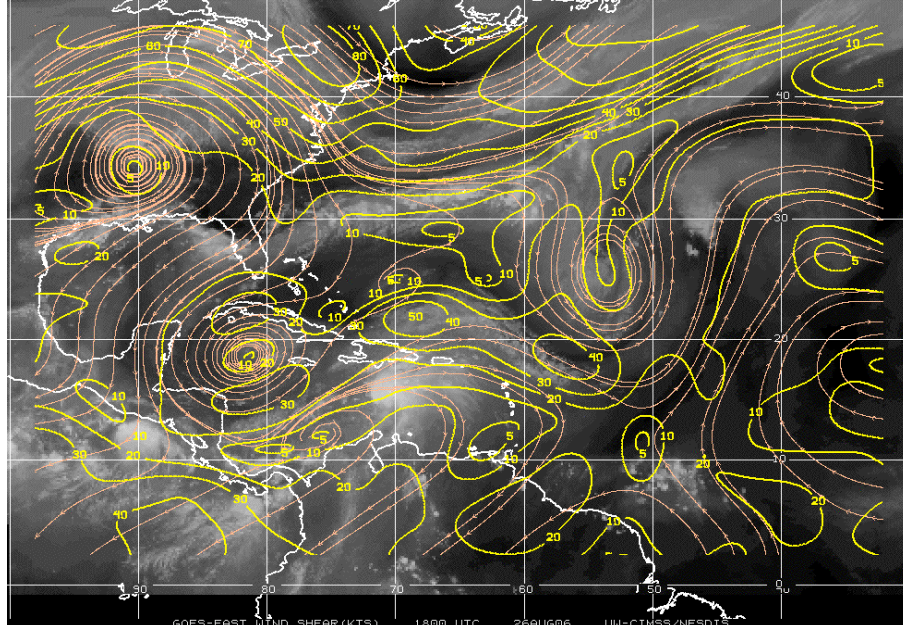


Fig. 4: Plot of vertical wind shear [magnitude (direction) of the wind shear is indicated by yellow contours (orange streamlines)] for 26 August 1800 UTC. Debby was located at  $\sim 26.3^{\circ}\text{N}$   $47.4^{\circ}\text{W}$  at this time. Images courtesy of UW/CIMSS.

#### b) Mission Specifics

The flight plan was designed to investigate a large SAL outbreak that was surrounding Tropical Storm Debby (Fig. 5, SAL 2) and the moist tropical environment immediately surrounding the storm [Fig. 5 (TPW  $>45$  mm)]. The flight plan called for initial sampling southeast and east the storm at an optimal flight level of 41,000-45,000 ft. A subsequent west-east leg took the G-IV over the approximate location of Debby's center of circulation. Finally, the region west and southwest of the storm was sampled. All GPS dropwindsondes were transmitted in real-time, so that the humidity data from the sondes could be included in parallel runs of the NOAA GFS model.

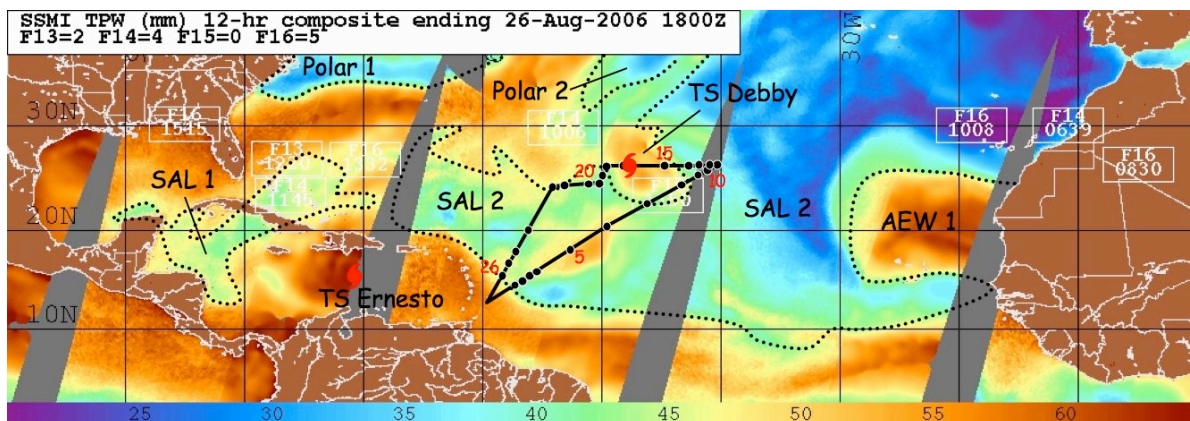


Fig. 5: Mosaic of total precipitable water (TPW) from the constellation of SSM/I satellites (1800 UTC 26 August 2006). Regions where TPW values of  $<45$  mm (dotted lines) indicate dry air in the low to mid-levels of the atmosphere ( $\sim 600$ - $925$  hPa). Two distinct areas of dry SAL air (SAL 1 & 2), two areas of dry polar air (Polar 1 & 2), an African easterly wave (AEW 1), and Tropical Storm Ernesto (TS Ernesto) are indicated in the imagery. The G-IV flight track and dropsonde points are overlaid on the imagery. Debby was located at  $\sim 26.3^{\circ}\text{N}$   $47.4^{\circ}\text{W}$  at this time. Imagery courtesy of NRL-Monterey.

Takeoff was at 1450 UTC from Barbados and within ~20 min (Fig. 5, drop #1), the G-IV was overflying the SAL (Fig. 5, SAL 2). Meteosat-8 visible imagery from 1800 UTC [Fig. 6 (left)] and zoomed AMSR-E TPW imagery from 1635 UTC suggested that dry SAL air was likely being advected toward the inner core region of the storm. The AMSR-E TPW imagery indicated that the SAL had advanced well into the inner core region of the storm [Fig. 6 (right), TPW <45 mm (green shading)]. Saharan dust was also clearly visible during a large portion of the mission and can be seen as a milky white haze in Meteosat-8 visible imagery [Fig. 6 (left)]. The suspended Saharan dust is discernable as a milky white haze in this visible satellite image. Figure 7 shows the 060826n flight track overlaid on the 26 August 1800 UTC GFS analysis of 700 hPa relative humidity. Preliminary data from GPS dropwindsondes suggests that the GFS was significantly overestimating the mid-level moisture in regions of the SAL during this mission.

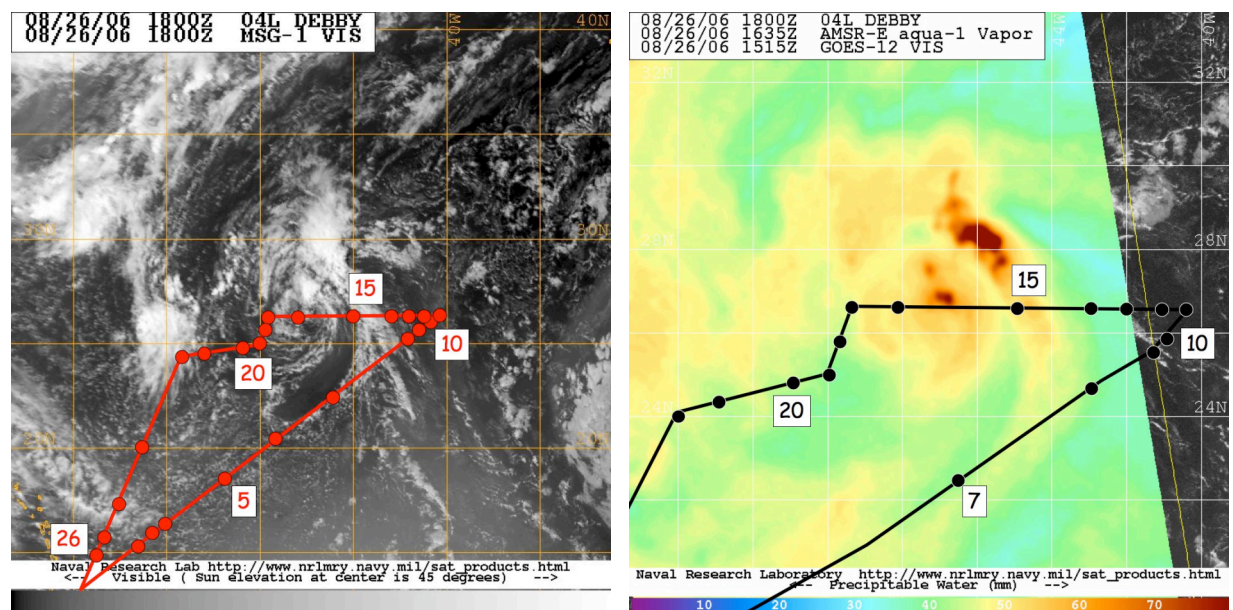


Fig. 6: Meteosat-8 visible imagery (left) and Aqua AMSR-E total precipitable water (TPW) imagery (right) showing Tropical Depression Debby. The SAL's dry, dusty air is evident in the visible image east and southeast of Debby (seen as a milky white haze) and is indicated by values of <45 mm (green to blue shading) in the TPW image. The G-IV flight track and dropsonde points are overlaid for reference.



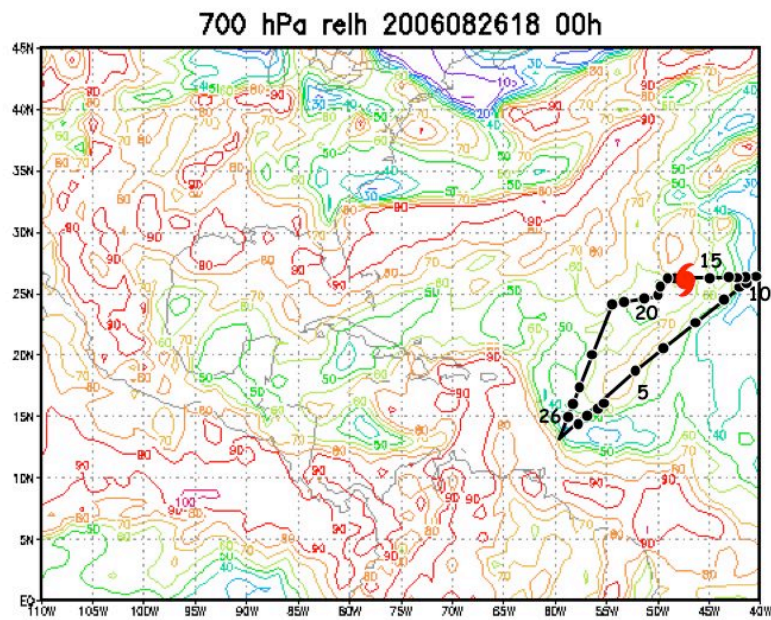


Fig. 7: Analysis of GFS 700 hPa relative humidity (%) for 26 August 1800 UTC. The G-IV flight track (black lines), GPS dropsonde points (black circles), and location of TD Debby are overlaid on the analysis.

#### **Problems:**

There were no major problems related to this flight. Although “codeless” GPS dropsondes mainly from 2000-2004 were used, only two sondes failed out of the 28 that were dropped.